Draft - FISCAL YEAR 2015 - Draft
EPA REGION 6 END-OF-YEAR EVALUATION
RAILROAD COMMISSION OF TEXAS
UNDERGROUND INJECTION CONTROL PROGRAM

Introduction

Since 1982, the Railroad Commission of Texas (RRC) has maintained its Underground Injection Control (UIC) primacy enforcement responsibility for Class II oil and gas related injection wells authorized by the federal Environmental Protection Agency (EPA) pursuant to Safe Drinking Water Act (SDWA) requirements. EPA later approved RRC's primacy program for Class III brine mining wells and energy related Class V injection wells. The RRC implements State UIC primacy permitting and enforcement programs for Class II wells through an alternative demonstration under SDWA Section 1425 and for their limited Class III and V primacy program under SDWA Section 1422.

As part of the EPA/RRC primacy agreements, EPA Region 6 retains oversight responsibilities that includes an annual end-of-year evaluation. This annual oversight report summarizes RRC activities since EPA's last end-of-year evaluation for FY2009, as reported by the RRC in fulfillment of its primacy program and Federal UIC grant and workplan commitments.

Section 1 FY2015 Grant Workplan

Pursuant to receiving federal assistance through SDWA Part C authorization, the RRC submitted and EPA approves an annual grant application and associated workplan that outlines goals, expected milestones for key program activities, and estimated funding to toward achieving those goals and milestones. The grant application and workplan for FY2015 were approved by Region 6 on July 1, 2014.

Section 1.1 FY2015 Grant Award and Allocation

The federal FY2015 grant allotment for the Texas Railroad Commission's (RRC) UIC program was $631,720 in UIC programmatic funds; these funds are determined annually based on the annual well inventory numbers submitted by State UIC Primacy programs. In addition, the RRC received $8,900 in UIC special project funds during FY2015.

Section 1.2 Grant Deliverables

Pursuant EPA regulations and policies, environmental programs conducted on behalf of EPA will establish and implement effective quality systems. The Quality Management Plan (QMP) and Quality Assurance Project Plan (QAPP) must be up dated annually. If both the QMP and QAPP are current and valid, EPA requires each state to annually certify that both plans are current by submitting updated signatory pages and organizational charts as applicable. The FY2015 QMP [QTRAK #15-326] was approved by Region 6 on 7/17/2015,

and expires on 7/17/2016. The FY2015 QAPP [QTRAK #16-036] was approved by Region 6 on 11/12/2015, and expires on 11/12/2016. Table 1 includes the workplan due dates and date of receipt for documents submitted by RRC as specified in the grant workplan.

Table 1. Grant deliverables in FY2015 UIC Workplan.

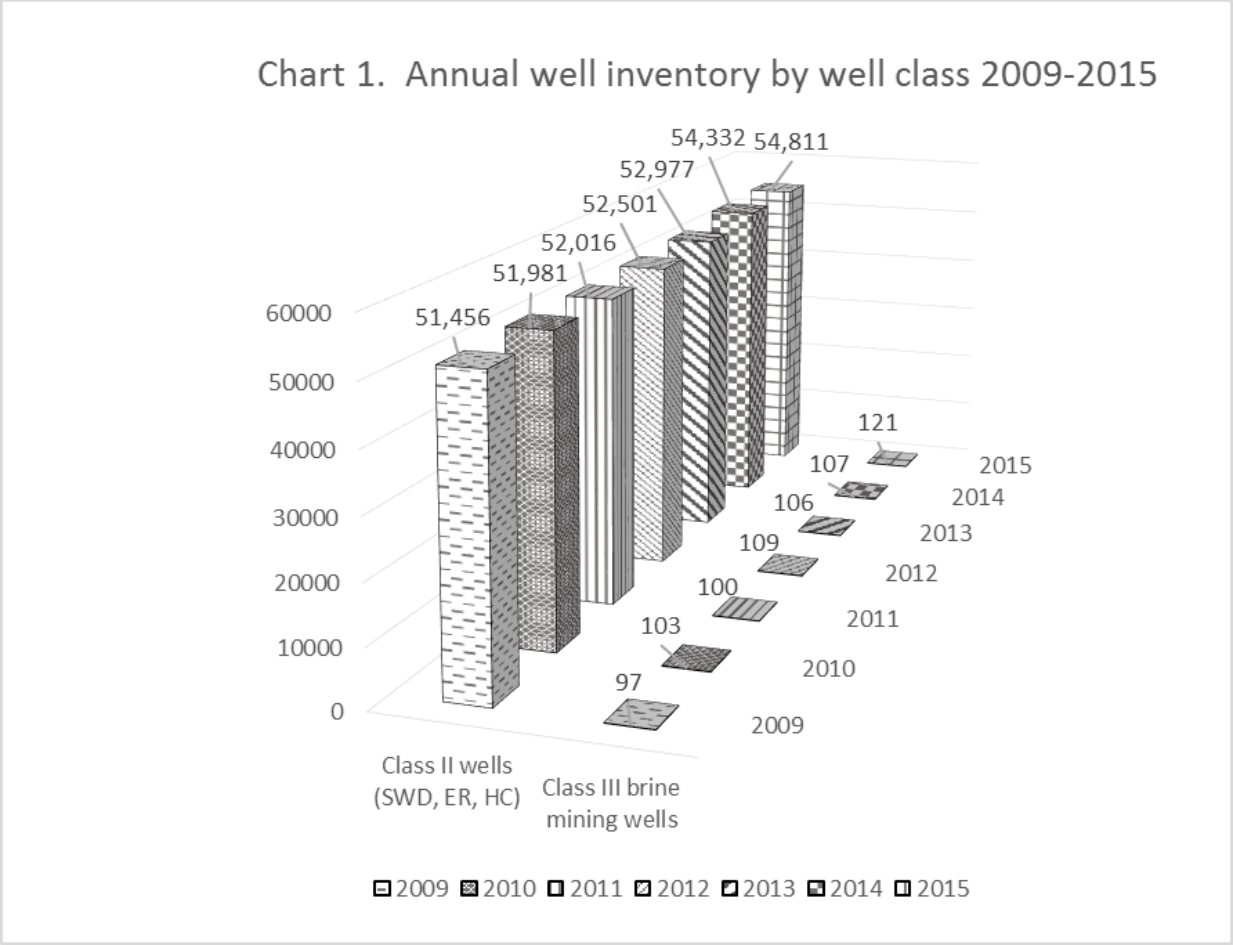
Grant Deliverable	Due Date	Date Received
Quarterly Reports (EPA Forms 7520)	4/30/2015; 10/31/2015	Submitted on schedule
FY2014/2015 Grant Application FY2014/2015 Grant Workplan	7/01/2014	Application received- 5/16/2014 Workplan received- 5/16/2014 Approved - 5/20/2014
Final Financial Status Report (FY15)	11/30/2015	The Final FSR reviewed and processed 2/01/2015. Grant is closed.
Annual UlC Program Report (FY15)	10/31/2015	9/28/2015
Update on Program, Regulatory or Statutory Changes	10/31/2015	9/28/2015
Annual QMP/QAPP Updates*	QMP QAPP	Received- 6/23/15 Approved- 7/17/15 Expires- 7/17/16 Received- 11/06/15 Approved-11/12/15 Expires- 11/12/16
UIC Well Inventory for FY15	12/18/2014	12/18/2014

* The Quality Management Plan (QMP) and Quality Assurance Project Plan (QAPP) are updated annually.

Section 2 Inventory

Chart 1 illustrates the number of injection wells reported by class to EPA annually by the RRC from 2009 through 2015; the State UIC program annual inventory numbers are usually submitted during or near December each year. These values (along with values reported by other State and EPA UIC programs) are used by EPA to calculate the annual grant funds allocated to each State UIC program. Since SDWA regulation of underground injection wells began, the

RRC UIC program is still the nation's largest State Class II program based on the total number of Class II injection wells [salt water disposal (SWD), enhanced recovery (ER), and hydrocarbon storage wells (HC) combined] reported annually. Injection wells used in natural gas storage operations are regulated by the RRC, but are exempt from regulation under the SDWA and not generally subject of EPA UIC oversight.



The annual number of Class II wells (all types) reported since 2009 has increased by 3,355, an approximate 6.5 percent increase during the six-year period. Between 2009 and 2013, the number of Class II wells increase by less than 1 percent annually; in 2014 and 2015, the reported number increase by 2.6 percent and 1.6 percent, respectively.

The number of Class III brine mining wells increased from 97 in 2009 to 121 in 2015, an increase of 24 or an approximate 25 percent increase during the six-year period. In 2015 alone, the number of authorized Class III brine mining wells increased by 14, a 13 percent increase from 2014.

In addition to the inventory submitted to EPA annually, the RRC also includes inventory values in their annual narrative report pursuant to the EPA/State UIC grant workplan; the inventory values in the narrative report seem to include all types of injection wells, Class II, III, and possibly V, based on the larger numbers. Those inventory numbers are not used in this

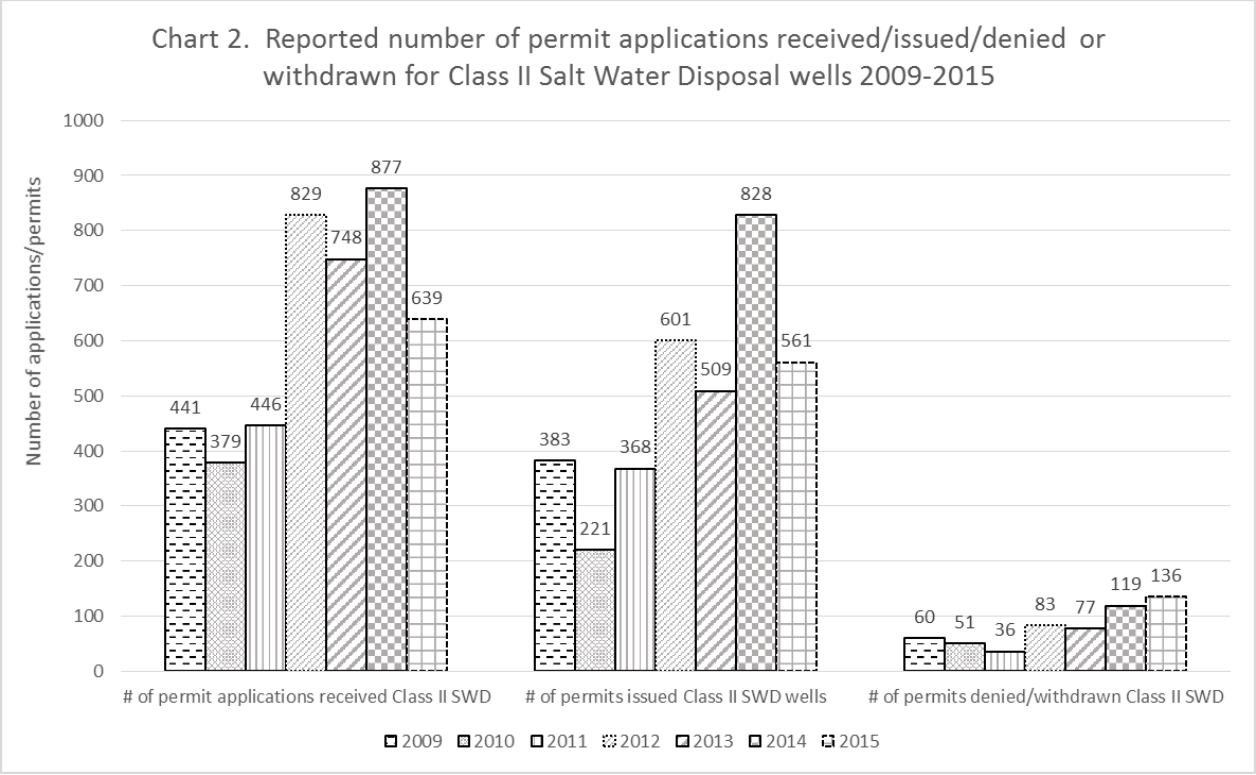
evaluation. The RRC annual narrative reports between 2009 and 2015 are attached to this annual evaluation as Appendix I.

Section 3 Key Program Activities

This section includes an evaluation of key program measures as reported annually to EPA by the RRC through EPA's Forms 7520 and the annual narrative required in the annual UIC grant workplan. The charts in this section includes information submitted by the RRC from 2009 through 2015.

Section 3.1 Permitting

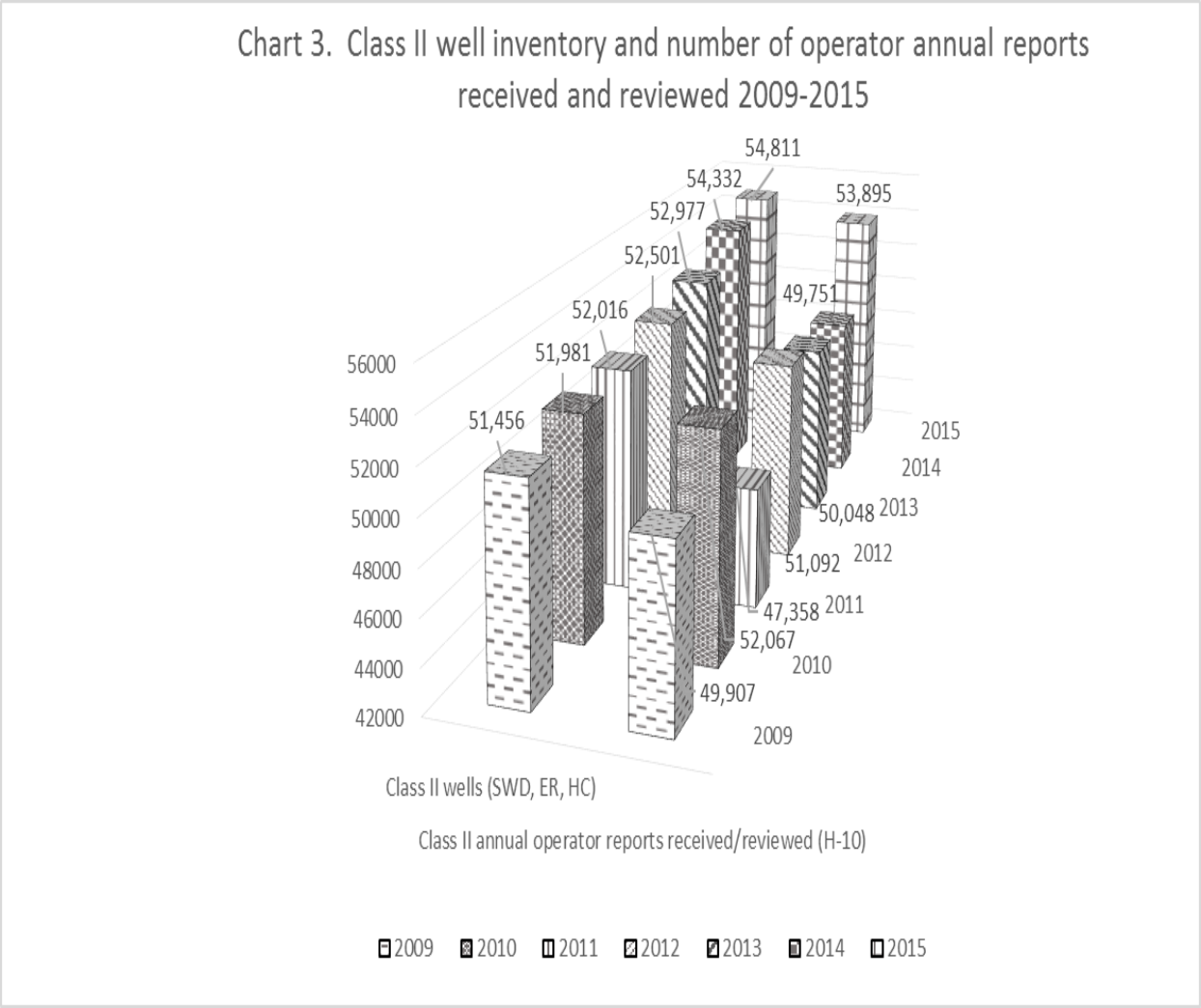
The previous Section 2 includes information on permitted wells regulated by the RRC; all injections wells authorized by the RRC are authorized by RRC permit. There are no authorized-by-rule injections wells regulated by the RRC. Chart 2 presents the number of Class II UIC permit applications received for salt water disposal (SWD), the number of new Class II SWD UIC permits issued, and the number of SWD UIC permit applications either denied or withdrawn from 2009 through 2015. The values were taken from EPA Forms 7520 submitted by the RRC annually since 2009.



The number of permits received increased in 2012 by about 85 percent from 2011 numbers, remains relatively constant during 2013 and 2014 and declines approximately 27 percent in 2015; that same decline is not reflected in the number of permits denied or withdrawn in 2015.

Section 3.2 Annual UIC Operator Reports

Chart 3 illustrates the annual Class II well inventory graphed with the number of annual monitoring reports submitted by operators for Class II injection wells (SWD, ER, and HC) since 2009.

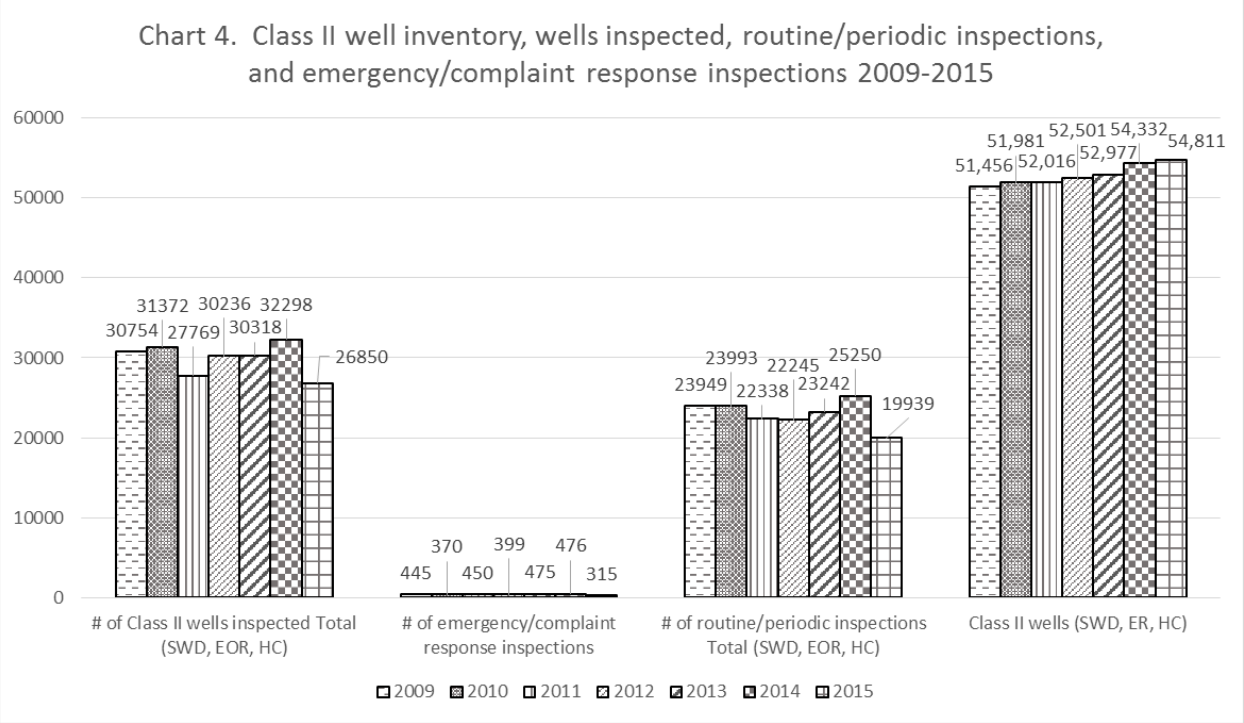


The RRC requires operators of injection wells to complete and submit Form H-10 annually; Form H-10 includes specific well identification information and monthly measurements of injection pressures, injected volumes, and casing/tubing annulus pressures. During the last seven annual reporting periods included in this report, the RRC received and reviewed annual reports of almost 97 percent of all Class II permitted injection wells. Annually, the percentage of H-10s collected ranged from over 100 percent in 2010 to almost 91 percent in 2011. The annual numbers of H-10s received and reviewed were taken from the RRC's annual narrative report, while the Class II inventory values throughout this report were taken from annual well inventory report submitted annually by RRC to EPA near the end of each calendar year. The annual narrative reporting period is the state fiscal year, July 1-June 30; while the annual well inventory

report is the number of regulated wells near the end of each calendar year as requested by EPA. For this reason, the comparison percentage of Class II well inventory and operator annual monitoring reports is an approximation. The low number of wells for which the operators of record did not submit a form H-10 may be a result of the operator being no longer in business or non-reported wells being either transferred, plugged, or abandoned.

3.3 Class II Injection Well Inspections, Mechanical Integrity Testing, and Enforcement

For Class II wells, Chart 4 compares the annual inventory with the number of wells inspected, number of routine/periodic inspections, and number of inspections in response to emergencies or complaints. From 2009 through 2015, the average number of inventoried Class II injection wells inspected for compliance in the field was near 57 percent, with the lowest percentage of about 49 percent in 2015. Based on the reported values, more than half of the reported number of authorized injection wells in Texas are inspected annually, and from Chart 3, the RRC collects and reviews operator-submitted monitoring information of approximately 97 percent of the Class II well inventory annually. Those numbers assure more than adequate inspection and monitoring surveillance actions.

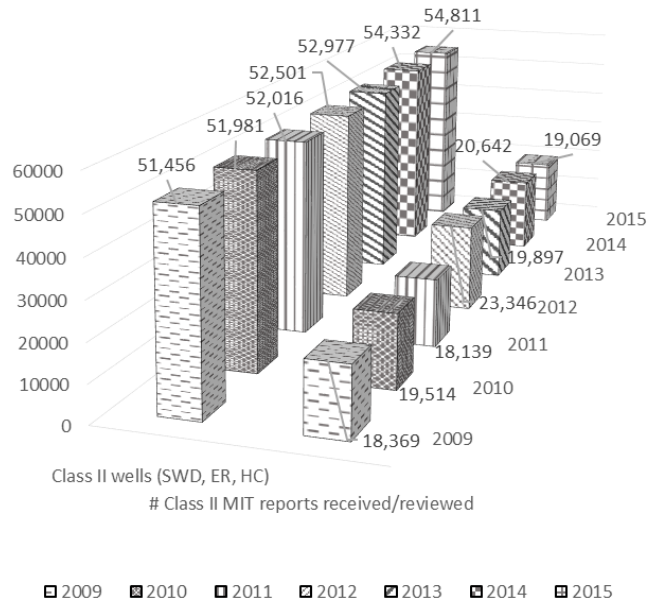


Most of the reported inspections are performed as routine or periodic injection wells inspections. On average, inspections performed under emergency or complaint response conditions comprise just over 1 percent of all Class II inspections (2,930 of 209,597 from 2009-2015). These values reflect an outstanding enforcement monitoring program.

The most important indicator of ground water protection in any UIC program is the mechanical integrity testing program, or MIT. A properly conducted MIT evaluates the condition of the well casing, tubing and packer to assure acceptable operating conditions. In most cases, an MIT is a

pressure test of the casing/tubing annulus and the associated packer; a test failure indicates a possible pathway for injected fluid to move out of the approved injection zone into or toward an underground source of drinking water. This procedure is fundamental in any UIC program and is required at least every five years for Class II wells. Chart 5 shows the number of Class II MIT reports received and reviewed by the RRC compared to the inventory of Class II wells from 2009-2015.

Chart 5. Class II well inventory and number of mechanical integrity test reports received and reviewed 2009-2015

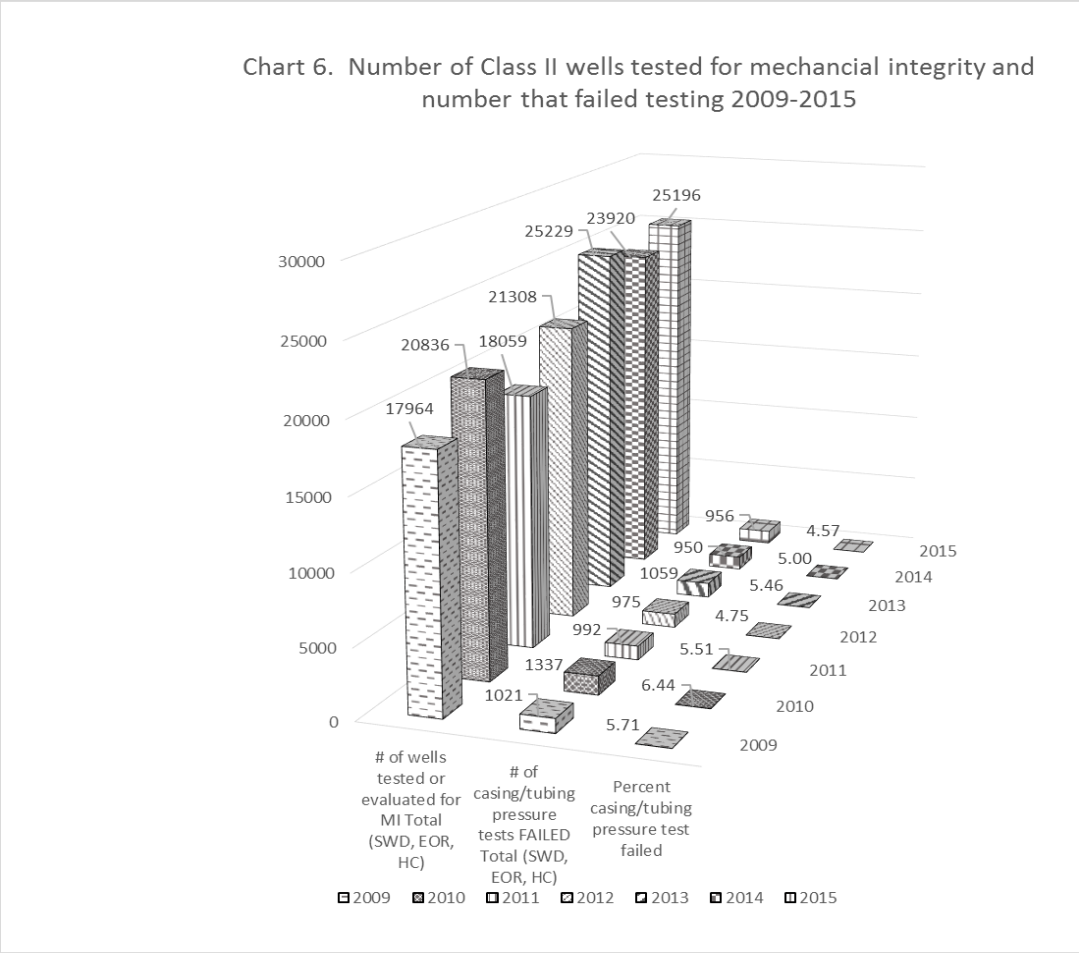


On average, the number of injection wells tested for mechanical integrity annually equals about 37 percent of the reported annual inventory of Class II wells, with the greatest frequency, 45 percent, reported for 2012. In summary, these MIT values indicate that over one-third of the reported annual inventory of Class II wells are likely tested for mechanical integrity annually. Based on these reported MIT values, the RRC testing and surveillance program exceeds the testing requirement for the MIT five-year performance measure.

If any injection well fails MIT, the applicable regulatory agency, whether State or EPA, disallows further operation until the operator shows the well has been repaired and passes a subsequent MIT. MIT failures are reported to EPA annually through Forms 7520 and may also be included in the State UIC program's annual narrative; the reporting period for Forms 7520 is the Federal fiscal year, October 1 – September 30, while a State's annual narrative generally covers the State fiscal year. A large percentage, greater than 80 percent, of Class II wells are tested for mechanical integrity by a pressure test of the casing/tubing annulus.

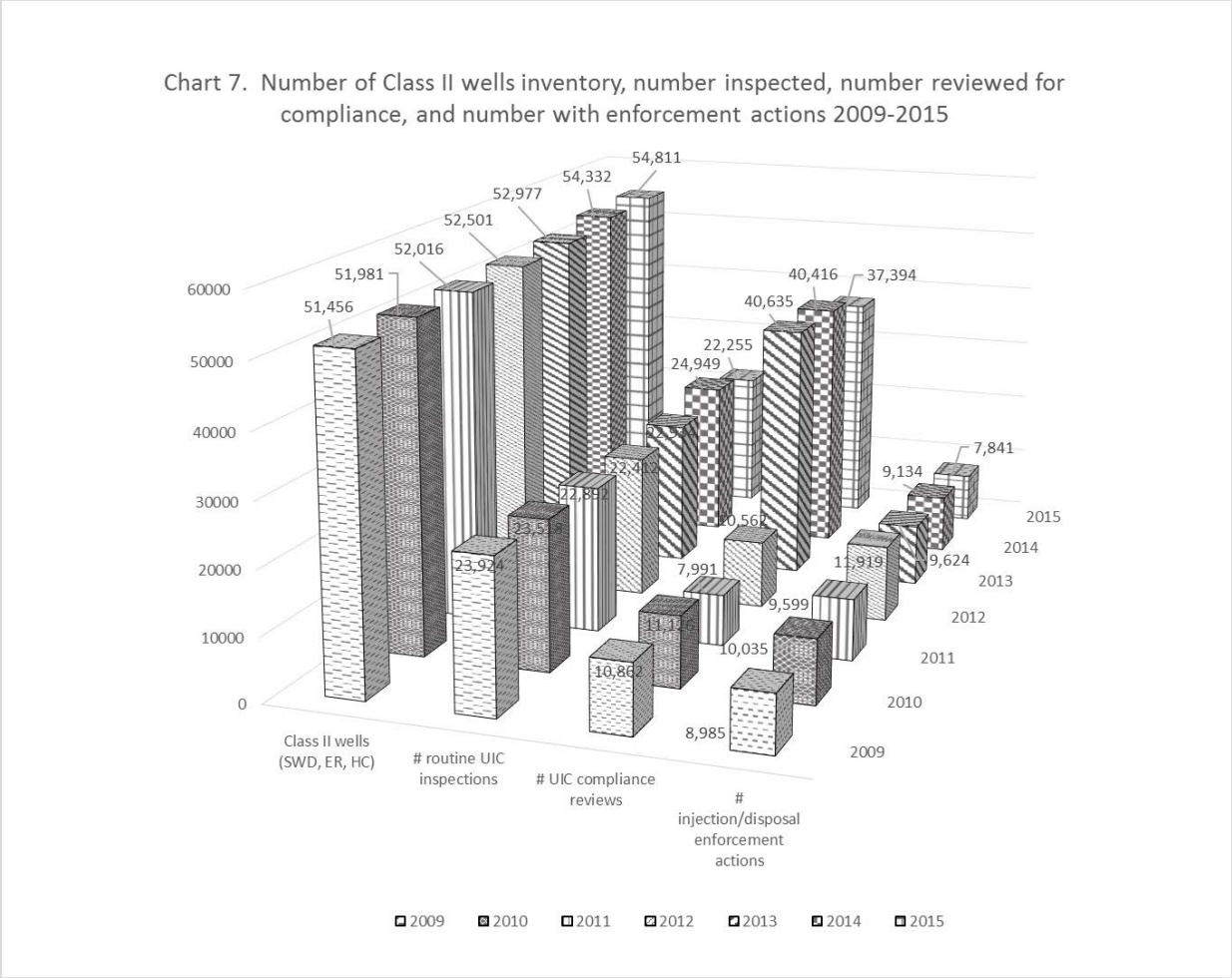
Chart 6 below illustrates the number of wells reported by the RRC through the annual Forms 7520s for the number of Class II wells tested for mechanical integrity and the number that failed casing/tubing pressure testing from 2009 through 2015. Other MIT evaluations may include

cement record evaluations and geophysical logging techniques including radioactive tracer surveys, temperature or noise logs, and oxygen activation logs.



Since 2009, the percentage of MIT failures reported by the RRC ranges between 4 and 7 percent of the Class II wells tested. This failure percentage range is consistent with the percentage in other State Class II UIC programs in Region 6.

Most Class II State UIC programs strive toward inspecting all their wells at least annually to assure proper surface operations and monitor for any pressure related issues. Chart 7 compares the number of routine UIC inspections, compliance reviews, and enforcement actions with the annual reported Class II well inventory submissions. The inspections, compliance reviews, and enforcement actions values were taken from the RRC's annual narratives from 2009 through 2015. Based on these data, approximately 44 percent of Class II injection wells undergo routine UIC inspections annually. Prior to 2013, the RRC reports show approximately 20 percent of Class II wells were reviewed for compliance with applicable State UIC requirements; beginning in 2013, the number of reported Class II compliance reviews increased approximately 300 percent from 10,000 plus in 2012 to over 40,000 in 2013. In the last three years approximately 75 percent of Class II wells in Texas were reviewed for compliance annually.



The number of Class II enforcement actions from 2009 through 2015 range from under 8,000 in 2015 to almost 12,000 in 2012. On average, the number of injection/disposal enforcement actions reported during this period represent about 18 percent of Class II wells in Texas.

In total, EPA Region 6 believes the RRC compliance surveillance and enforcement program appears responsive to operator reports and received complaints based on the information provided by the RRC. A summary of specific oversight issues are summarized in the remainder of this evaluation.

Section 4 Specific Oversight Issues

Since 2009, EPA Region 6 has communicated with the RRC about three primary UIC program concerns:

1. Increase seismic activity related to authorized Class II disposal,

2. Apparent formation pressure increases in East Texas associated with authorized Class II disposal, and

3. Identification and delineation of aquifers exempted at Class II program primacy in 1982, and any aquifers exempted by the RRC since 1982 related to oil and gas operations.

Section 4.1 Seismic Activity Correlated with Class II Disposal Injection

The EPA/State UIC National Technical Workgroup report on injection induced seismicity was released in February 2015. The report provides recommendations and strategies to injection well regulators for managing and minimizing suspected injection induced seismicity, and is available at the following website: http://www.epa.gov/sites/production/files/2015-08/documents/induced-seismicity-201502.pdf. Among other things, development of the report involved a comprehensive review of scientific literature, detailed analysis of four recent case examples (including North Texas) and exploring the applicability and value of petroleum engineering methods in the assessment of potential induced seismicity. RRC was one of the state agencies that participated in this effort and is commended for its influential involvement. RRC is also commended for establishing new regulations specific to seismicity, including solidifying RRC authority to take appropriate action related to injection well operations.

Although several areas in Texas experienced potential injection induced seismicity over the last several years, recent public, media and regulator interests have focused on the North Texas activity, specifically the Dallas-Ft Worth area. This includes activity in and around the cities of Azle, Cleburne, as well as near DFW Airport. The strategies RRC employed in these cases included early engagement of disposal well operators near the seismic activity. This action resulted in successful voluntary closure or injection volume reduction for several Class II disposal wells. Seismic activity in these three areas substantially diminished in frequency and magnitude; however, earthquake events continue in other areas of North Texas, most notably, frequent events in and near the city of Irving in Dallas County.

RRC has publicly stated that available scientific data do not support a correlation between recorded earthquakes and Class II waste disposal. In light of findings from several researchers, its own analysis of some cases, and the fact that earthquakes in some areas diminished following shut-in or reduced injection volume in targeted wells, EPA believes there is a significant possibility that North Texas earthquake activity is associated with disposal wells.

As indicated in the EPA/State workgroup report mentioned above, naturally fractured injection formations may transmit pressure buildup from injection for miles. The Ellenberger Formation, a deep naturally fractured formation, is the preferred disposal zone for most disposal wells in North Texas. This geophysical characteristic of the Ellenberger may allow pressure from authorized injection activities to follow existing fracture pathways toward existing fault zones miles away. These fractures may also be transmitting pressure buildup downward to basement rock along faults that were previously dormant.

EPA is concerned with the level of seismic activity during 2015 in the Dallas/Ft. Worth area because of the potential to impact public health and the environment, including underground sources of drinking water. EPA recommends close monitoring of injection activity through daily

recording and reporting of accurate injection pressures and volumes from area disposal wells, coupled with appropriate data analysis methods, in a coordinated effort to detect possible correspondence with seismic activity.

Section 4.2 East Texas Formation Pressure Increases Related to Class II Disposal

A large volume of produced brine in East Texas is injected underground into authorized Class II disposal wells. Many of those wells are permitted commercial facilities that receive exploration and production (E&P) oilfield wastes produced from East Texas and Northwest Louisiana. The volume of produced oilfield wastewater historically increases as hydrocarbon reservoirs produce less oil and gas proportionate to associated formation salt water brine. Injection of the increasing volumes of produced brine into Class II disposal wells in East Texas is believed to be the cause of documented pressure increases in some geologic formations, primarily the late-Cretaceous Rodessa Formation. RRC records indicate that many production wells in East Texas lack cement between the well casing and Rodessa Formation; this cement void may provide a pathway for pressure transfer into another zone. Such pressure transfer could cause the observed high bradenhead pressures in some production wells in the area.

In 1991, EPA first authorized the disposal of restricted hazardous waste into a Class I hazardous disposal well at the current Pergan Marshall LLC facility near Marshall in Harrison County, a county in the East Texas area of focus. This authorization is required under Section 3004 of the Resource Conservation and Recovery Act. As early as 2006, the regulatory required annual pressure fall-off well tests that monitor pressure changes began to show a significant increase in formation pressure; the Pergan Marshall disposal well injects waste fluid into the Rodessa Formation. In 2014, the pressure fall-off tests showed pressures non-compliant with EPA-approved conditions. In September 2014, EPA published its denial decision for continued operation of the Pergan Marshall Class I hazardous disposal well (see Appendix II). During the time of the observed significant increases in the Pergan Marshall Class I well, the RRC also authorized a large number of Class II wells in Harrison County to dispose of produced brine. EPA believes the recorded pressure build-up in the Rodessa Formation in the area is a direct result of authorized Class II disposal in a large number of authorized injection wells.

As early as 2012, the RRC recognized a regional increase in geologic formations used to dispose of produced brine associated with oil and gas production. The RRC documented an increase of bradenhead pressure for a large number of production wells in a three county area in East Texas: Harrison, Panola, and Shelby.

Beginning in 2012, RRC's Oil and Gas Division requested bottom-hole pressure (BHP) data from operators of 86 commercial disposal wells in those East Texas counties; in April 2014, the RRC modified permitted injection pressures for many of those wells and required continuing annual pressure fall-off testing and BHP monitoring to assure protection of underground sources of drinking water. The BHP data received and analyzed ranged from approximately 0.106 pounds per square inch per foot of depth (psi/ft) to 0.92 psi/ft. Most of these data are from disposal in the Rodessa Formation for which a salt water gradient of 0.46 psi/ft is often used by the RRC. Based on historical and the new operator data including pressure fall-off test reports,

the RRC found areas with elevated pressures and areas where pressure is not a problem, but no clear trend has emerged as nearly all operators have reported only once.

RRC staff are using all available data when reviewing new disposal well applications for both commercial and non-commercial Class II disposal wells in the three county area. Factors considered in the RRC permitting process include:

1. The construction and completion of all wells within a ½-mile area of review,
2. The BHP of the proposed disposal formation, if available, and
3. The proposed injection rate of wastewater, both volume and pressure.

Permits have been issued for some wells where application data indicate that pressures will not be a problem; those permits contain special monitoring and reporting conditions that will help the RRC determine how formation pressures change over time. The RRC expects additional data from identified operators in late 2015 and early 2016; after analysis of these new data, the RRC will update Region 6 on this issue.

Section 4.3 Identification and Delineation of Aquifer Exemptions, Pre and Post-Primacy

The RRC 1982 UIC primacy documents contain correspondence between EPA Region 6 and then RRC Director of Underground Injection Control, Jerry Mullican, specifically addressing aquifers proposed for exemption related to oil and gas production activities. Ultimately, an executed letter agreement between Region 6 Administrator, Dick Whittington, and Mr. Mullican dated March 29, 1982, crystallized proposed actions by both agencies at UIC primacy (see Appendix II).

In an effort to determine the historical outcome of this agreement, EPA Region 6 UIC staff met with RRC staff in Austin in December 2014; agreements reached in that meeting are documented in a letter dated July 14, 2015, from Bill Honker, Water Division Director, Region 6) to Leslie Savage, Assistant Director of Technical Permitting, Oil and Gas Division, RRC (see Appendix II). On November 10, 2015, Region 6 UIC staff again met with RRC representatives in Austin on this and other issues. RRC reported the effort is very resource intensive and staff continue to gather information in their records. The RRC is moving forward with identifying and delineating historical and current aquifer exemption areas which are considered exempt from full UIC regulation. Once the RRC completes its research, EPA anticipates further actions to document the areas of exemption. EPA recommends continued high prioritization of this effort.

Appendix I

Annual UIC program narrative reports

of

The Railroad Commission of Texas

2009-2015

Appendix II

1. May 19, 2014, EPA letter to RRC regarding East Texas pressure build-up issue.

2. September 29, 2014, EPA proposed denial package for Pergan Marshall LLC exemption petition.

3. March 29, 1982, EPA/RRC primacy letter agreement on aquifer exemptions.

4. July 14, 2015, EPA letter to RRC related to aquifer exemptions.